CSI-Thermal Program Solar Pool Installation Inspection Checklist

Customer Name:		**Address:**	**Rev. 1/2015**
Project Type (circle):	**Pool**		**Project ID:**
Initial Inspection Date:		**Initial RESULTS (circle): PASS FAIL**	**Inspector:** **Signature:**
Re-inspection Date:		**Re-Inspection RESULTS (circle): PASS FAIL**	**Inspector:** **Signature:**

FAILURE ITEMS

Inspection Item	Explanation	Inspection Findings	Pass or Fail
System Operation	Is the system operational? Are there any significant health/safety violations?		
Backup Fuel		Back up Fuel Source (circle): Natural Gas Electricity Additional Comments:	
Collector	The collector model and size must be consistent with the ICF and have SRCC and/or IAPMO label.	Number of collectors: Total square feet of collector area: Manufacturer: Model: Collector information consistent with ICF?:	
Collector Tilt		What is the tilt? _____	
Collector Azimuth		What is the true azimuth?_____	
Collector Flow Balance	Ensure proper flow balancing in and among collector banks by using reverse return plumbing or flow balancing valves and adhering to manufacturer's maximum collectors allowed in banks and collectors allowed in series flow.	Does the number of collectors in series match that input into the online calculator ?	
Collector Circulation Control	The collector subsystem control shall be compatible with control requirements of the system. For year-round system, an automatic solar controller is required.	Is there a controller for all pools?	
Solar Tank (Not Required for Pool, unless needed for drainback or a commercial/mf combination system)	If a tank is used for drainback, is it capable of holding the volume of fluid in the collectors and roof piping?	Number of Solar Tanks: Total Solar Storage Capacity_____. Collector loop volume_____.	
Waterproofing	Underground and above ground unsheltered storage tanks shall be waterproofed to prevent water seepage.Storage tanks used outdoors shall be rated for outdoor use. Controls or other weather vulnerable components shall be protected from weather effects by a shed or weatherproof enclosure.		
Operating Limits	Means shall be provided to protect the solar pool heating system within the design limits of temperature and pressure. All pool systems will require proper expansion joints or loops on collector headers and footers and all supply and return piping. The pressure/temperature relief valve shall not be used for this purpose under normal operating circumstances. PRV valves are not required for unglazed pool applications with no glycol. The system shall be able to withstand prolonged periods of stagnation (high solar flux, no pool heat demand) without significant system deterioration and with no maintenance. This includes conditions during loss of electrical power to the system. Unglazed pool collectors are exempt from the need for glycol overheat protection. Glycol systems using glazed collectors or evacuated tube collectors must have approved overheat protection. All piping must be able to withstand expected stagnation temperature effects, including consideration of worst case roof and ambient temperature .	Circle applicable Stagnation Protection mechanism: Controller with vacation mode Controller with stagnation prevention cycling mode Steam back Heat dump radiator or convector Pressure Stagnation Protection Hartstat Thermosiphon Protection Swimming Pool and Spa Heat Dump	

Freeze Protection Measures	**Pool Heating Systems:** The only freeze protection methods permitted for year-round pools are glycol, or closed or open loop drainback. Manual drainback may be use only if in conjunction with seasonal freeze protection. a. Glycol. Glycol products must be pre-approved by the collector manufacturer. The glycol product used must be identified in the Owner's Manual. b. If Drainback freeze protection is used, all risers must be sloped at least 1/4 inch continuously(or the gradient recommended by the manufacturer if greater) to enable the collector arrays to drain completely when the solar pump shuts down. Riser sags may not prevent the collector from draining. All headers and footers over 1 1/2" may have 0 slope or positive slope to drain as required by manufacturer's installation manual. Drainage for year round pools, must be into a storage tank, surge tank or the swimming pool. Piping for gravity drainage, for year round pools whether for manual or automatic drainage, may not rise over a parapet wall or other obstacles. For systems piped in a drainback configuration, a vacuum breaker is required to be installed on the highest point, or in a location as per the manufacturers recommendation. Means shall be provided at the collector loop/filter pump interface to ensure that drainback will occur. c. Direct Forced Circulation (DFC) freeze protection with flow recirculation is not allowed. d. Verify and/or identify drainback function. **Flat roofs:** The only freeze protection method allowed for year round systems with collectors laid flat with no gradient is Indirect Forced Circulation (IFC) with glycol. For seasonal pools relying on manual drainage, the collectors may be laid flat only if the owner and contractor sign an affidavit certifying that a service contract has the solar contractor manually drain the collectors, or the pool owner agrees to take responsibility for freeze protection measures by draining the solar system before the winter season begins, and the Owner's Manual instructs the owner how and when to drain the solar system. Piping for manual gravity drainage for seasonal pools must account for the rise over a parapet wall or other obstacles in the lines providing the drainage. For seasonal pools, a parapet wall may not prevent the owner from manually draining the collectors by reasonable means. **Note:** It is the installer's responsibility to use an appropriate freeze protection method for the specific climate or micro-climate conditions, and to understand freezing may occur during the months of May through October.	**Seasonal pools on flat roofs with no gradient and manual drainage:** Is there a maintenance agreement and drainage instruction in Handbook? **'IFC Glycol:** Is there a pressure gauge showing minimum acceptable collector loop pressure? 'Is there at least a 1/4 inch per foot vertical drop in the collector risers, continuous, unless a higher gradient is required by the manufacturer?	
Documentation Requirements	**Photographs:** Example of collectors and piping slope Example of freeze protection measures Parapet wall drainage of solar system if applicable. Example of expansion loops or joints on all collector headers, footers and supply and return piping Example of roof penetrations CPM meter if applicable Label on diverter valve		
Glycol systems: pressure gauge	A pressure gauge showing minimum acceptable collector loop pressure shall be provided.	Is the min allowable pressure marked on the gauge?	
Drainback: water level gauge	A water level gauge or a properly installed transparent in-line flowmeter shall be installed on pool heating systems that utilize a closed loop drainback tank or reservoir. This is not required on drainback systems that drain into the pool or a sump tank.	Is there a water level indicator mounted to show the collector loop level when the pump is off?	
Protection from UV Radiation	Pool piping that is not rated as UV-resistant must be painted or otherwise protected from UV degradation.		
Insulation	Polymer pool piping that is recommended to not be insulated by the collector manufacturer, or is normally uninsulated for pool solar systems, need not be insulated. Metal tubing must be insulated. However the contractor should use judgment in very cold microclimates.	Is metal tubing insulated?	
Back Thermosyphon Prevention	Means shall be provided to prevent undesired escape of heat from storage through thermosyphoning action. Drainback systems do not require protection.	Acceptable means are below (circle): Check valve Solenoid valve 18" Heat Trap	
Protection from Leaks	All piping and components must be leak free. All roof penetrations must be properly sealed and leak free. Evidence or presence of fluid or roof leaks constitutes a failure. Visible signs of leaks or penetrations through sheathing is considered a failure item.	Are there signs of leakage?	
Water Damage	Collectors and support shall be installed in such a manner that water flowing off the collector surface or from the pressure relief valve shall not damage the building or cause premature erosion of the roof.	If glazed or evacuated tube collectors used, is there a danger that high temperature fluid could damage the roof security?	
Control Line and Sensors	All wires and connections, sensors, pneumatic lines, hydraulic lines or other means for transmitting sensor outputs to control devices shall be sufficiently protected from degradation or from introducing false signals as a result of environmental influence such as wind, moisture, temperature or other factors which may alter their intended sensing function. Weather-exposed wiring must be rated sunlight and moisture resistant and comply with NEC Articles 340 and 690. Sensor wiring shall be separated from hot collector piping and shall be protected from UV.	Are sensor wires protected from UV, electromagnetic interference, and high temperature?	

Owners Manual	An owner's manual or manuals shall be provided with each pool system. The manual shall contain the name, phone number and address of the system supplier, and shall describe the operation of the system and its components and the procedures for installation, operation and maintenance. The manual shall provide instructions for manual draining (if applicable) for winterization. The instructions shall state under wha night temperature forecast the owner must drain the collectors, and when and how to restart the solar system in spring.	Is an Owners Manual provided?	
Meters	For Solar Pool Systems >30kW: Installed meters must be approved by the contractor and owner, and may consist of a BTU meter calculator, or any combination of devices that can continuously measure and store either onsite or remotely collector loop flow rate and temperature rise and provide a BTU measurement. There is no accuracy requirement. Any flow gauge used must not inhibit drainback function. Note. It is advisable to consult with the pool owner re the type of metering to be installed. Meters for swimming pool application do not require preapproval. The following are metering options for pool CPM applications: 1. BTU meter used for domestic water heating systems with insertion flow sensor (usually a turbine or paddlewheel),with temperature sensors, 2. Grundfos Vortex type flow sensor with temp sensors in the collector loop, if the flow sensor reads flow continuously 3. BTU meter with ultrasonic meter permanently attached to the pipe, with temp sensors, 4. Energy Management System with temperature sensors, flow meter and BTU calcs. Note: The PAs will consider reviewing and approving other pool BTU measurement options.	Metering Purpose (circle): CPM PBI Make: Model: Serial Number: Consistent with ICF? Approved for identified metering purpose?	
Unglazed Collectors for Pools	In addition to other pool system inspection criteria stated, the following apply: 1) Gradient for drainback systems: All risers require 1/4" per ft minimum slope for drainback operation(or the manufacturer's requirement, if more stringent). Risers must not sag so that any part of the riser does not have less than 1/4 inch slope. 2) Gradient for Glycol, Gradient is not required for these systems. 3) All Collectors must be installed with sufficient clearance or protection to prevent collector headers or footers from rubbing across roof surfaces.		

INFRACTION ITEMS

Inspection Item	Explanation	Inspection Findings	
Manuals for ICS, Glycol and Drainback Systems	An ICS Owner's Manual shall, among normal matters, explain the owner's responsibility to drain the system when the temperature may drop below the temperature that freeze damage may occur. Glycol Systems Owner's Manuals shall, among other matters, recommend the next date when the glycol should be tested. Drain Back systems Owner's Manuals shall recommend regular checking by the owner of the water level.		
Shade Factor	Shade Factor must be within ± 5% of shade factor on ICF.	Shade Factor: Is shading within allowable parameters?: Is shading consistent with ICF?:	
Solar Loop Isolation	All isolation valves shall be labeled with their normal operating position indicated. Pools may attain the effect of bypass via motorized diverter valve or operational controls as long as the pool filtration function is not impaired. Pools require a mixing valve only if the solar loop water is fed directly into the pool, untempered. Acceptable means are: Properly installed mixing valves or ASSE anti-scald valves with a set point option appropriate for use. Other ASSE rated anti-scald valves such as point-of-use anti-scald valves.		
Temperature Control/Mixing Valve	Pools require a mixing valve only if the solar loop water is fed directly into the pool, untempered. Acceptable means are: Properly installed mixing valves or ASSE anti-scald valves with a set point option appropriate for use. Other ASSE rated anti-scald valves such as point-of-use anti-scald valves.		
Pressure Relief	Each portion of the system where excessive pressures can develop shall have a pressure relief device to ensure that no section can be valved off or otherwise isolated from a relief device. Automatic pressure relief devices shall be set to open at not more than maximum design pressure, or as limited by code and shall drain to a code-approved point or glycol collection tanks. PRV's shall drain to a safe location.		
Entrapped Air	If trapped air can impair the proper flow through the collectors, means shall be provided to purge trapped air. Acceptable methods are air vents or pumped velocity of approximately 2 FPS or more.		
Operating Indicators	The SWH systems shall include means for an observer to determine readily that the system is operating properly and providing solar heated water. As a minimum, a temperature indication is required for the solar storage tank except for passive systems. For pool systems below 30kWth, measuring delta T is sufficient, unless over 30kWth, where an approved CPM meter is required.		

Fluid Safety Labeling	Labels shall mark all drain and fill valves in the pool system if glycol is used. Each label shall identify the fluid in that loop. The location of fluid handling instructions shall be referenced. The label shall list the heat exchanger type and heat transfer fluid class as defined by the American Water Works Association, Cross Connection Control Manual. (Water is Class I. Propylene Glycol with inhibitors is Class II.) The label shall include a warning that fluid may be discharged at a high temperature and/or pressure. The label shall contain the following warning: "No other fluid shall be used that would change the original classification of this system. Unauthorized alterations to this system could result in a hazardous health condition."		
Expansion Tank	Expansion tanks shall be sized in accordance with manufacturer's instructions or ASHRAE methods. Provision shall be made to handle all fluid thermal expansion/contraction.		
Rain and Snow on Collector	The location, orientation, and position of the collector surface relative to nearby objects and surfaces shall be such that water run-off from the collector surface is not impeded nor is excessive build-up of snow on lower portions of the collector glazing permitted to occur.		
Pumps and Control	Pumps and controllers shall be appropriate for the intended use and shall be listed by recognized standards organizations.		
Water Shut-Off	The SWH system shall be valved to provide for shut-off from the service water supply without interrupting normal cold water service to the residence.		
Service Connections and Permanent Maintenance Accessories	Suitable connections and permanent maintenance accessories shall be provided at readily accessible locations for filling, draining and flushing liquid systems.		
Buried Components	Non-plastic solar components and materials that are intended to be buried in soils shall be protected from degradation under in-service conditions to insure that their function shall not be impaired. Use proper jacketing and flashing to prevent rain penetration. Only existing buried PVC piping is allowed. All other existing PVC piping must be replaced.		
Pipe and Component Supports	All piping shall be supported as required to prevent sagging under the temperature conditions expected.		
Thermal Expansion	The system design, piping, components and subassemblies shall include adequate provisions for the thermal contraction and expansion of heat transfer fluids and system components that will occur over the design temperature range. Note. PVC can expand over 4.5" per 100 foot length at a temperature rise of 100°F. Clamps must provide adequate room for growth in both the longitudinal direction and the radial direction. The program reserves the right to request substantiation that the pipe material chosen will withstand the worst case temperature/pressure expected. All Collectors must be installed with sufficient clearance or protection to prevent collector headers or footers from abrasively rubbing across roof surfaces with potential to cause damage to either surface.		
Building Penetrations	**For All Systems:** Penetrations of the building through which piping or wiring is passed shall not reduce or impair the function of the enclosure. Penetrations through walls or other surfaces shall not allow intrusion by insects and/or vermin. Required roof penetrations shall be made in accordance with applicable codes and also practices recommended by the National Roofing Contractor's Association. Should inspector notices obvious roof issues, an infraction will be noted and forwarded to the site owner.		
Pitch or Angle of Piping Installation	Piping should be sloped toward drain ports or the pool with a drainage slope of no less than 0 inch per foot or more if recommended by the manufacturer. Not required for non-drainback systems, or manually drained seasonal systems.		
General comments			

If possible inspect under-roof for signs of daylight or screws protruding